CHROMOSOME STUDIES IN MELAMPODIUM (COMPOSITAE, HELIANTHEAE)

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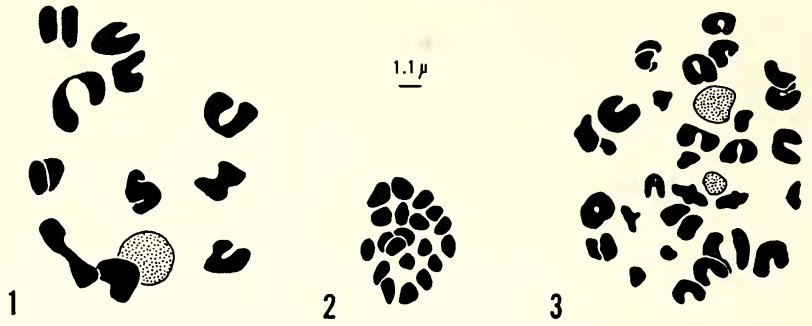
A number of chromosome counts for the genus *Melampodium* already have been reported (Negodi, 1938; Jackson, 1957; Turner, Beaman, and Rock, 1961; Turner and Johnston, 1961; Turner and King, 1962; 1964; Turner and Flyr, 1966). These studies surveyed 21 of the 35 presently recognized in the genus (Stuessy, 1968) and indicated the presence of intraspecific polyploidy in several taxa (Turner and King, 1962). In addition, base numbers for the genus have been tentatively proposed as $\mathbf{x = 9}$ (Negodi, 1938) and $\mathbf{x = 10}$ (Turner and King, 1962). The present studies significantly add to previous work by 1, most importantly, putting the old counts into the framework of the recent taxonomic concepts and nomenclature (Stuessy, 1968), 2, adding new counts for two species, 3, surveying intra- and inter-populational chromosome variability throughout the ranges of many species which more clearly indicates the significance of polyploidy in each species and in the whole genus, and 4, clarifying certain problems mentioned in earlier chromsome treatments.

Methods and Materials. Buds for meiotic counts were collected in the field in modified Carnoy's fixative, 4 parts chloroform, 3 parts absolute alcohol, and 1 part glacial acetic acid, and refrigerated in the laboratory (Walters, 1952), until subsequently counted by acetocarmine squash techniques. Material stored in this manner lasted as long as one year and still produced clear meiotic figures, although some hardening of the cells was noticed.

Seeds for the few mitotic counts were treated as in Speese and Baldwin (1952), first being germinated on filter paper in petri dishes, pretreated for an hour in a saturated aqueous solution of PDB, then fixed in 3:1:1 (3 absolute alcohol: 1 chloroform: 1 glacial acetic acid) and finally squashed under acetocarmine stain.

Results and Discussion. Table 1 lists the various chromosome counts known for the genus *Melampodium*. Due to problematical nomenclature, many previous counts were reported under names now regarded as synonyms (Stuessy, 1968). In addition, the recognition of new varieties in *M. cinereum, M. leucanthum* and *M. montanum* (Stuessy, 1968) has required putting old counts referred to these species into the proposed respective varietal categories.

Two species, *M. glabrum* and *M. hispidum,* are here reported for the first time as $\mathbf{n = 11}$ (fig. 1) and $\mathbf{n = 20}$ (fig. 2), respectively. *Melampodium glabrum* thus coincides cytologically with the morphologically similar species, M. perfoliatum ($\mathbf{n = 11, 12}$), which strengthens the

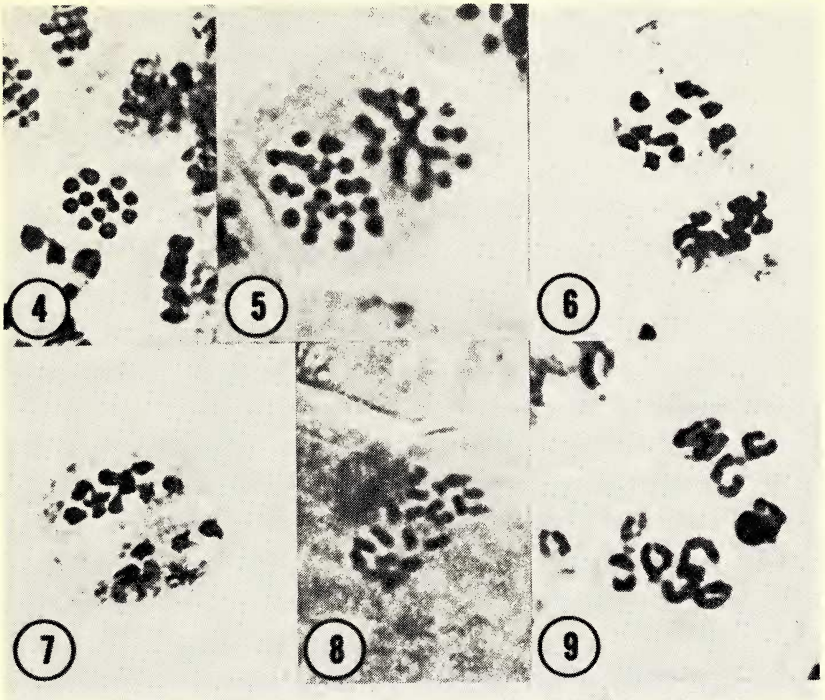


FIGS. 1–3. Camera lucida drawings of chromosomes of species of *Melampodium:* 1, *M. glabrum,* diakinesis, **n = 11**, *Stuessy 708;* 2, *M. hispidum,* metaphase II (½ of cell drawn, **n = 20**, *Stuessy 1038;* and 3, *M. sericeum,* diakinesis, **n = 30**, *Stuessy 364.*

inferred close phyletic relationship of these two taxa. *Melampodium hispidum* is a mountainous species very similar morphologically to *M. sericeum* (**n = 30**; 20 large and 10 small bivalents, fig. 3). It may be that an ancestor of *M. hispidum* was involved in the evolution of this hexaploid species, perhaps contributing the 20 larger bivalents. The close morphological similarity of *M. sericeum* to another species, *M.* sp. nov. (*P. Goldsmith 133;* chromosomally unknown but placed in the **x = 10** section of the genus), suggests that an ancestor of the latter may have donated the smaller set of 10 bivalents. This speculative origin of *M. sericeum* contrasts markedly with that indicated by Turner and King (1962). While they noted the close relationship to *M. hispidum* (first perceived by Robinson, 1901), they suggested the possible involvement of an ancestor of *M. camphoratum* (**n = 16**) by the incorporation of some of its small chromosomes into the genome of the incipient *M. sericeum* through amphiploidy. But since *M. camphoratum,* in my opinion, belongs to the rather distantly related genus *Unxia* (closely related to *Polymia*), the likelihood of such an origin seems remote.

Extensive surveying of many populations of species previously counted (118 new population reports) has shown that all but three species are apparently uniformly diploid throughout most of their ranges. The diploid-tetraploid races in *M. cinereum* and *M. leucanthum* noted by Turner and King (1962) have been verified in the present study (table 1) and will be discussed at length elsewhere. *Melampodium dicoelocarpum* is the only other species that has been found to possess polyploid races, being diploid at **n = 12** (new report, fig. 4) and aneuploid (at the tetraploid level) with **n = 23** (fig. 5). Although quantitative morphological differences are present between the latter two races, too few counts have been made and too few herbarium records are available to comment on significant geographical or ecological differences.

Melampodium longipilum has been counted previously only once



FIGS. 4–9. Photographs of chromosomes of species of *Melampodium:* 4, 5, *M. dicoelocarpum,* metaphase II; 4, $\mathbf{n = 12}$, *Stuessy 693;* 5, $\mathbf{n = 23}$, *Stuessy 716;* 6–8, *M. longipilum;* 6, 7, anaphase I, $\mathbf{n = 10}$, *Stuessy 373;* 8, metaphase, $\mathbf{2n = 20}$, *Stuessy 634;* and 9, *M. perfoliatum,* diakinesis, $\mathbf{n = 11}$, *Stuessy 379.* All approximately × 1800.

(Turner and King, 1962), the authors commenting that, "This collection is interesting in that its habit and floral features are similar to *M. divaricatum,* but the achenes bear well-developed hoods such as are characteristic of the section *Melampodium.* Its chromosome number, $\mathbf{n = 11}$, however, would be exceptional for the latter section." Although on close examination this species is quite distinct within the genus, it seems morphologically closest to *M. diffusum* ($\mathbf{n = 10}$) and on this basis would be expected to fall into the section *Melampodium.* Since meiotic (and one mitotic) counts have been made from six populations of this species in the present study (table 1) and all have yielded unequivocal counts of $\mathbf{n = 10}$ (figs. 6–8), it is probable that the normal chromosome number of this species is $\mathbf{n = 10}$.

The reported counts of *M. perfoliatum* (Turner and King, 1962; 1964) have been both $\mathbf{n = 11}$ and $\mathbf{n = 12}$. Although the present study recorded only counts of $\mathbf{n = 11}$ for this species (fig. 9), more survey work is needed to discover the factors involved in the establishment and maintenance of these two chromosomal levels, if two indeed exist. The

chromosomal voucher specimens of the two races cannot be distinguished morphologically.

The early counts of $n = 10$ for both *M. divaricatum* and *M. perfoliatum* reported by Negodi (1938) accompanied by descriptions and photographs of the plants, contrast with the consistent subsequent counts of other workers of $n = 12$ and $n = 11$ and 12, respectively. It is likely that these unusual $n = 10$ counts represent either very anomalous conditions or perhaps erroneous observations.

Negodi (1938) was the first to discuss the taxonomy of *Melampodium* in a phyletic sense. Based on counts of $n = 9$ and $n = 10$ for three species, he felt that $n = 9$ was the ancestral base, followed by an aneuploid gain to $n = 10$. Turner and King (1962) however, comment that, "It is obviously impossible to know what the ancestral basic chromosome number for the genus might have been, but it does seem significant that the number, $n = 10$, is found in a wider range of morphological types than is any other number." The fact that a large number of morphologically diverse species within a genus has a certain characteristic (e.g., $x = 10$) by no means designates this unequivocally as a primitive trait. But it may be suggestive, especially in recently evolved groups such as the Compositae. Nevertheless, phylogenetic speculations including base number hypotheses must be based on all available evidence, not numerology or one or two characters alone. Further insight into aneuploid trends in *Melampodium* must wait for a compilation of evidence that is accumulating on other aspects of the genus.

Field work for this investigation was supported in part by NSF Traineeship 4128, NSF grant GB-1428, and a Sigma Xi Grant-in-Aid. Appreciation is expressed to P. H. Raven and B. L. Turner for permission to include several unpublished chromosome counts, and to R. S. Irving, J. L. Strother, and B. L. Turner for several bud collections. This study represents a portion of a dissertation (supervised by B. L. Turner) submitted to the Graduate School of the University of Texas at Austin in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Note added in proof: *M. hispidum* has been counted recently as $n = 20$ by Powell and Sikes (1970).

Table 1. Chromosome Counts in Melampodium

All voucher specimens cited in this study are deposited in the University of Texas Herbarium, Austin.

All citations are meiotic counts showing clear bivalents unless otherwise indicated at the end of each voucher citation.

Superscripts after voucher specimens refer to counts not made by the author but found in the following references:

[a] Negodi (1938)

[b] Jackson (1957)

[c] Turner, Beaman and Rock (1961)

[d] Turner and Johnston (1961)
[e] Turner and King (1962)
[f] Turner and King (1964)
[g] Turner and Flyr (1966)
[h] Powell, A. M., and B. L. Turner (unpublished)
[k] Raven, P. H. (unpublished)
[m] Turner, B. L. (unpublished)
[n] Turner, B. L., W. L. Ellison, and R. M. King (unpublished)

Different voucher numbers from the same locality refer to counts from buds from an individual plant (listed first) and from a populational sample. Irving, Stuessy and Turner collections of *M. cinereum* and *M. leucanthum,* however, are all individual plants.

M. americanum L. **n = 10**. GUATEMALA. Baja Verapaz: near Salamá, *King 3260* (reported as *M. americanum* var.)[e]; Progreso: 35 mi NE of Guatemala, *Stuessy 602*. MEXICO. Chiapas: Santa Isabel, *Stuessy 632;* Colima: Alzada, *Stuessy 727;* Guerrero: 9 mi NW of Taxco, *King 4168* (reported as *M. kunthianum*)[e]; 25 mi NE of Acapulco, *King 4178* (reported as *M. kunthianum*)[e]; Michoacán: 7 mi S of Ario de Rosales, *Stuessy 688,689;* Nayarit: 25 mi N of Tepic, *King 3699*[n]; Vera Cruz: 20 mi. E of Cuitlahuac, *King 2679*[e]; 26 mi E of Cuitlahuac, *King 2682*[e]; 9 mi NW of Alvarado, *King 2709*[e]; 9 mi SE of Alvarado, *King 2718*[e]; 24 mi E of Cuitlahuac, *Stuessy 314, 315;* 27 mi S of jct rtes 110 & 105; *Stuessy 469, 470* (ca **10**); 19 mi S of Diamante, *Stuessy 481;* 34 mi NW of José Cardel, *Stuessy 484, 485;* 14 mi E of La Tinaja, *Stuessy 516;* Salinas, *Stuessy 518, 519;* near Catemaco, *Stuessy 522*.

M. aureum Brandg. **n = 33**. MEXICO. Michoacán: 20 mi W of Ciudad Hidalgo, *King 3617*[e]; 21 mi NW of Ciudad Hidalgo, *Stuessy 683, 684;* Oaxaca: 7 mi NE of Nochistlán, *Stuessy 663* (& frag.).

M. cinereum DC. var. *cinereum*. **n = 10**. MEXICO. Tamaulipas: 59 N of Sabinas Hidalgo, *Stuessy 857a*. TEXAS. Hidalgo Co.: 6 mi E of Sullivan City, *Turner 4490* (reported as *M. cinereum*)[e]; Webb Co.: ca 22 mi NW of jct rtes 83 & 81 (35), *Stuessy 869;* 37 mi N of Zapata, *Thompson 174* (reported as *M. cinereum*[e]; Zapata Co.: 14.6 mi N of San Ygnacio, *Strother 556;* 27 mi N of Zapata, *Thompson 175* (reported as *M. cinereum*)[e]; Zavala Co.: 11 mi SE of Batesville, *Sullivan & Turner 22* (reported as *M. cinereum*)[e]; 6 mi S of Batesville, *Turner 5006* (reported as *M. cinereum*)[g].

M. cinereum DC. var. *cinereum*. **n = 20**. TEXAS. Duval Co.: 25 mi N of Hebbronville, *Stuessy 429;* Jim Hogg Co.: 10 mi E of Hebbronville, *Stuessy 423* (ca **20**); near Hebbronville, *Stuessy 425;* Hebbronville, *Stuessy 426;* near Hebbronville, *Stuessy 428;* Hebbronville, *Thompson 177* (reported as *M. cinereum*)[e]; Jim Wells Co.: near Orange Grove, *Strother 565;* Live Oak Ca.: ca 32 mi S of Whitsett, *Stuessy 772, 773;* 14 mi S of George West, *Thompson 180* (reported as *M. cinereum*)[e]; Zapata Co.: 17 mi NE of Zapata, *Thompson 176* (reported as *M. cinereum*).[e]

M. cinereum DC. var. nov. **n = 10**. MEXICO. Coahuila: near Nueva Rosita, *Stuessy 902a;* 21 mi S of Monclova, *Stuessy 912;* Nuevo León: 15 mi N of Sabinas Hidalgo, *Stuessy 854;* 26 mi N of Sabinas Hidalgo, *Stuessy 855a;* 38 mi N of Sabinas Hidalgo, *Stuessy 856a*.

M. cinereum DC. var. *ramosissimum* (DC.) A. Gray. **n = 10**. MEXICO. Tamaulipas: San Fernando, *Stuessy 450, 541;* Reynosa, *Stuessy 778, 779;* 27 mi S of Reynosa, *Stuessy 787*.

M. cupulatum A. Gray. MEXICO. Sinaloa: near Culiacán, *Flyr 112* (reported as *M. rosei*)[g].

M. dicoelocarpum Rob. **n = 12**. MEXICO. Michoacán: 25 mi S of Ario de

Rosales, *Stuessy 693* (fig. 4).

M. dicoelocarpum Rob. **n = 23**. MEXICO. Michoacán: near Cotija, *King & Soderstrom 4646* (reported as *M. microcephalum*)[e]; 15 mi S of jct & rtes 15 & rd to Cotija, *Stuessy 715, 716* (fig. 5).

M. diffusum Cass. **n = 10**. MEXICO. Guerrero: 26 mi S of Acapulco, *Powell 758*[e]; Acapulco, *Stuessy 366*.

M. divaricatum (Rich. in Pers.) DC. **n = 10**. Plants obtained from bot. gard. Göteborg[a].

M. divaricatum (Rich. in Pers.) DC. **n = 12**. EL SALVADOR. Santa Ana: near Santa Ana, *Stuessy 609*. GUATEMALA. Alta Verapaz: 28 mi E of San Miguel Uspantán, *Stuessy 588; Jutiapa:* 25 mi E of Cuilapa, *Stuessy 605*. MEXICO. Campeche: Champotón, *Stuessy 532;* Chiapas: Tapachula, *Stuessy 626;* Morelos: 6 mi NW of Cuautla, *Stuessy 351;* 10 mi S of Cuernavaca, *Stuessy 358, 359;* Oaxaca: Huajuapan de León, *Stuessy 341;* Zimatlán, *Stuessy 655;* Tabasco: near Villa Hermosa, *Stuessy 547;* Vera Cruz: 23.2 mi SE of Alvarado, *Stuessy 319;* 12 mi S of Tantoyuca, *Stuessy 473* (& 2–3 frag.), *474;* 23 mi S of Tecolutla, *Stuessy 480;* Jalapa, *Stuessy 486;* 34 mi NW of Tehuacán, *Stuessy 506;* Fortin, *Stuessy 507;* 20 mi S of Alvarado, *Stuessy 520* (& 3–5 frag.); 49 mi SE of Catemaco, *Stuessy 526* (& 2 frag.); many Mexican states: 29 different population counts[e]. NICARAGUA. Granada: Granada, *Stuessy 620;* Managua: Managua, *Stuessy 616;* Matagalpa: Sebaco, *Stuessy 614, 615*.

M. sp. nov. **n = 25 ± 1**. COSTA RICA. Cartago: Turrialba, *King 5348* (reported as *M.* cf. *flaccidum*)[f].

M. glabrum Wats. **n = 11**. MEXICO. Jalisco: near La Barca, *Stuessy 707, 708* (fig. 1); Michoacán: 9 mi S of jct rte 15 & rd to Cotija, *Stuessy 714*.

M. gracile Less. **n = 9**. MEXICO. Campeche: Champotón, *Stuessy 530, 531;* 16 mi N of Champotón, *Stuessy 533;* Chiapas: 28 mi SE of Comitán, *King 3042* (reported as *M.* cf. *brachyglossum*)[g]; 17 mi S of Tuxtla Gutierrez, *King 3096* (reported as *M.* cf. *brachyglossum*)[e]; 32 mi SE of Comitán, *Stuessy 573;* Michoacán: near Jiquilpan, *King 3636* (reported as *M.* cf. *brachyglossum*)[g]; 3 mi NW of Zamora, *Stuessy 393;* 25 mi S of Ario de Rosales, *Stuessy 694;* Morelos: 7 mi NW of Cuautla, *Stuessy 354, 356;* San Luis Potosí: El Salto, *King 3887* (reported as *M. microcarpum*)[e]; Tamaulipas: 6 mi N of Antiguo Morelos, *Stuessy 454, 455;* 8 mi E of Antiguo Morelos, *Stuessy 458, 459;* 33 mi N of Ciudad Valles, *Stuessy 464;* 18 mi S of jct rtes 110 & 105, *Stuessy 466;* Yucatán: 13 km N of Mérida, *Stuessy 536, 537;* Vera Cruz: 13 mi W of Orizaba, *Graham & Johnston 4777*[d]; 13 mi W of Orizaba, *Johnston 4777* (reported as *M. microcarpum*)[e]; 7 mi SW of Morelos, *Powell 646* (reported as *M.* cf. *brachyglossum*)[e].

M. hispidum H. B. K. **n = 20**. MEXICO. Chihuahua: Cuauhtémoc,*Stuessy 1038* (fig. 2).

M. leucanthum Torr. & A. Gray var. *leucanthum*. **n = 10**. ARIZONA. Coconino Co.: near Sedona, *Turner 5738*[m]; Gila Co.: 16 mi NW of Globe, *Turner 5736;* Pima Co.: near Greaterville, *Turner 5735*[m]. COLORADO. Fremont Co.: near Portland, *Irving 823–1, 823–2, 823–3;* near Canon City, *Turner 5638;* Prowers Co.: 31 mi S of Lamar, *Irving 825*. MEXICO Chihuahua: 59 mi N of Villa Ahumada, *Stuessy 1122*. NEW MEXICO. Bernalillo Co.: *Jackson 2082* (reported as *M. leucanthum*)[b]; DeBaca Co.: 6 mi E of Yeso, *Turner 5673*[m]; Dona Ana Co.: Organ Mts, San Augustin Pass, *Turner 5748;* Eddy Co.: near Whites City, *Turner 5653;* Hidalgo Co.: 7 mi S of Road Forks, *Turner 5719;* Santa Fe Co.: 22 mi SW of Santa Fe, *Turner 5676*[m]; Torrance Co.: 3 mi NE of Duran, *Raven 19130*[k]. OKLAHOMA. Cimarron Co.: 6.8 mi N of Cimarron River on rte 287, *Irving 824-A, 824-B*. TEXAS. Blanco Co.: near Johnson City, *Thompson & Graham 17* (reported as *M. leucanthum*)[e]; Brewster Co.: Marathon, *Stuessy 230, 231;* near Brewster-Pecos Co. line on rte 90, *Stuessy 235* (ca **10**); Culberson Co.: 6 mi S of Van Horn, *Turner 4738*[m]; El Paso Co.: 28 mi SE of El Paso, *Stuessy 1126;* Loving

Co.: Mentone, *Stuessy 182;* Oldham Co.: 16 mi N of Vega, *Turner 5632, 5632b;* Presidio Co.: near Marfa, *Stuessy 201, 202, 203, 204 (& frag.), 206, 207* (ca **10**), *213;* Redford, *Stuessy 227, 228;* Travis Co.: near Austin, *Thompson & Graham 87* (reported as *M. leucanthum*)[e]; Mt. Bonnell, Austin, *Stuessy 138;* Winkler Co.: 1 mi N into Winkler Co. on rte 18, *Stuessy 152, 153, 154;* Kermit, *Stuessy 167, 168, 169.*

M. leucanthum Torr. & Gray var. *leucanthum.* **n = 20.** TEXAS. Blanco Co.: 10 mi N of Johnson City, *Thompson & Graham 18* (reported as *M. leucanthum*)[e]; Hays Co.: Dripping Springs, *Thompson & Graham 16* (reported as *M. leucanthum*)[e]; Travis Co.: near Austin, *Thompson & Graham 15* (reported as *M. leucanthum*)[e]; near jct Balcones Rd & *2222, Stuessy 418;* Mansfield Dam, *Stuessy 420* (ca **20**); 7 mi SW of Zilker Pk, Austin, *Stuessy 752* (**2n = 40**). *755-3, 755-4.*

M. linearilobum DC. **n = 10.** EL SALVADOR. San Salvador: 24 mi E of turnoff to San Vicente, *Stuessy 612, 613.* GUATEMALA. Jutiapa: 8 mi NE of Jutiapa, *Stuessy 606, 607.* MEXICO. Michoacán: Apatzingán, *Stuessy 697;* Oaxaca: 40 mi W of Tehuantepec, *King 2891*[e]; 11 mi E of Zanatepec, *King 3449*[e]; 37 mi W of Tehuantepec, *King 3454*[e]. NICARAGUA. Granada: Granada, *Stuessy 618, 619.*

M. longifolium Cerv. ex Cav. **n = 9.** MEXICO. Oaxaca: Las Sedas, *Stuessy 659*; San Luis Potosí: 22 mi E of San Luis Potosí, *Powell 551*[g]. Plants obtained from bot. gard. Copenhagen[a].

M. longipes (A. Gray) Rob. **n = 10.** MEXICO. Jalisco: Tequila, *King 3662*[e]; Tequila, *Stuessy 396, 737, 738.*

M. longipilum Rob. **n = 10.** MEXICO. Guerrero: 19 mi N of Chilpancingo, *Stuessy 373* (figs. 6, 7), *374;* Oaxaca: 13 mi NW of Tehuantepec, *Stuessy 328, 329*; 3.8 mi NW of Huajuapan de León, *Stuessy 343*; 10 mi NW of Tehuantepec, *Stuessy 633, 634* (**n = 10 & 2n = 20**, fig. 8); near Huajuapan de León, *Stuessy 666*; Puebla: Tehuitzingo, *Stuessy 667.*

M. longipilum Rob. **n = 11.** MEXICO. Oaxaca: 64 mi SE of Oaxaca, *King 3461* (reported as *M.* sp. nov.)[e].

M. microcephalum Less. **n = 9.** GUATEMALA. Huehuetenango: 6 mi S of Huehuetenango, *King 3425* (reported as *M. oblongifolium*)[e]. MEXICO. Chiapas: 10 mi SE of Tonalá, *Stuessy 627, 628;* Michoacán: near Ciudad Hidalgo, *King 3607*[e] (reported as *M. oblongifolium*)[e]; 6 mi NW of Tuxpan, *Stuessy 383, 384;* near Ciudad Hidalgo, *Stuessy 680, 681;* Oaxaca: Monte Albán, *Stuessy 638.*

M. montanum Benth. var. *montanum.* **n = 11.** MEXICO. Oaxaca: 10 mi N of jct rtes 190 & 175, *King 3492* (ca **11**; reported as *M.* cf. *montanum*)[e].

M. montanum Benth. var. nov. **n = 11.** GUATEMALA. Huehuetenango: between Chemal & San Juan Ixcoy, *Beaman 3043* (reported as *M. montanum*)[e]. MEXICO. Chiapas: 17 mi W of San Cristóbal de Las Casas, *King 2796* (reported as *M. montanum*)[e]; 5 mi E of San Cristóbal de Las Casas, *King 2801* (reported as *M. montanum*)[e]; Tecpisca, *King 2843* (reported as *M. montanum*)[e]; 34 mi S of Ishuatán, *Stuessy 559, 560;* 20 mi W of San Cristóbal de Las Casas, *Stuessy 566.*

M. paniculatum Gardn. **n = 18.** GUATEMALA. Alta Verapaz: near San Pedro Carchá, *King 3329* (reported as *M. mimulifolium*)[e]; San Pedro Carchá, *Stuessy 594;* Huehuetenango: near Huehuetenango, *King 3417* (reported as *M. dicoelocarpum*)[e]; Huehuetenango, *Stuessy 578;* 12 mi E of Huehuetenango, *Stuessy 582;* Sololá: near Panajachel, *King 3242* (reported as *M.* cf. *mimulifolium*)[e].

M. perfoliatum (Cav.) H. B. K. **n = 10.** Plants obtained from bot. gard. Göteborg[a].

M. perfoliatum (Cav.) H. B. K. **n = 11.** COSTA RICA. Cartago: Turrialba, *King 5350*[f]; near Cartago, *King 5407*[f]. *GUATEMALA.* Guatemala: Guatemala, *King 3248* (reported as *M.* cf. *perfoliatum*)[e]; Huehuetenango: Huehuetenango, *King 3410* (reported as *M.* cf. *perfoliatum*)[e]; Huehuetenango, *Stuessy 576.* MEXICO. Michoacán: 45 mi W of Morelia, *King 3635* (reported as *M.* cf. *perfoliatum*)[e]; 8 km S of Uruapán, *King & Soderstrom 4707*[f]; Ciudad Hidalgo, *Powell & Edmondson 816*

(reported as *M.* cf. *perfoliatum*)[e]; Zitacuaro, *Stuessy 379* (fig. 9), *380;* Oaxaca: Zimatlán, *Stuessy 654.*

M. perfoliatum (Cav.) H. B. K. **n = 12.** MEXICO. Michoacán: 11 mi W of Michoacán-Mexico state border, rte 15, *King 3600*[e]; Puebla: near Puebla, *King 3560*[f].

M. rosei Rob. **n = 10.** MEXICO. Simaloa: Mazatlán, *Flyr 138*[g]; 13 mi N of Rosario, *King 3710*[e]; 21 mi N of Rosario, *King 3712*[e]; near Mazatlán, *King 3715*[e]; 10 mi NE of jct rtes 40 & 15, *King 3716*[n]; Isla Piedra, *Stuessy 747, 748;* near Mazatlán, *Stuessy 749, 750.*

M. sericeum Lag. **n = 30.** MEXICO. Guerrero: Petaquillas, *Stuessy 364* (fig. 3); Michoacán: Zitacuaro, *Stuessy 377* (ca **30**); 7 mi S of Ario de Rosales, *Stuessy 690 (& frag.) 691;* Oaxaca: 53 mi S of Tehuacán, *Powell 660* (reported as *M. sericeum* var. *sericeum*)[e]; Las Sedas, *Stuessy 660* (ca **30**); Querétaro: 6 mi W of Querétaro, *Powell & Edmondson 579* (ca **30**, reported as *M. sericeum* var. *exappendiculatum*)[e]; near Querétaro, *Rock M-442* (reported as *M. sericeum* var. *exappendiculatum*)[e].

M. tenellum Hook. & Arn. **n = 10.** MEXICO. Nayarit: 38 mi S of Sinaloa-Nayarit border, *King 3703* (reported as *M. cupulatum*)[e]; 28 mi S of Sinaloa-Nayarit border, *King 3704* (reported as *M. cupulatum*)[e]; ca 21 mi S of Sinaloa-Nayarit border, *King 3705*[n]; Sinaloa-Nayarit border, *King 3706* (reported as *M. cupulatum*)[e]; 27.9 mi SE of Nayarit-Sinaloa border, *Stuessy 401;* 10 mi NW of jct rte 15 & rd to Tuxpán, *Stuessy 744* (ca **10**), *745.*

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